

What is claimed is:

1. A separator for separating and distributing fluids at the periphery of a substantially planar membrane electrode assembly in a fuel cell, the membrane electrode assembly comprising first and second porous electrodes assembled onto opposing major surfaces of a substantially planar membrane electrolyte, the fuel cell comprising first and second flow field plates adjacent major surfaces of the first and second electrodes, respectively, the separator comprising:

- (a) sealing surfaces for sealing engagement with the periphery of the membrane electrode assembly and with the first and second flow field plates;
- (b) a first port for providing passage of a first fluid through the separator; and
- (c) a first set of fluid distribution features for fluidly connecting the first port to the flow field in the first flow field plate and for fluidly isolating the first port from the flow field in the second flow field plate.

2. The separator of claim 1 further comprising:

- (d) a second port for providing passage of a second fluid through the separator; and
- 5 (e) a second set of fluid distribution

PRINTED IN U.S.A.

features for fluidly connecting the  
second port to the flow field in the  
second flow field plate and for fluidly  
isolating the second port from the flow  
10 field in the first flow field plate.

3. The separator of claim 1 wherein the  
first set of fluid distribution features comprises  
a plurality of channels separated by lands for  
directing the first fluid to a plurality of  
5 channels in the first flow field plate.

4. The separator of claim 2 wherein the  
second set of fluid distribution features  
comprises a plurality of channels separated by  
lands for directing the second fluid to a  
5 plurality of channels in the second flow field  
plate.

5. The separator of claim 2 wherein the  
separator is substantially planar and the first  
and second sets of fluid distribution features are  
on opposing major surfaces of the separator.

6. The separator of claim 1 wherein the  
first fluid is a reactant.

7. The separator of claim 2 wherein the  
first and second fluids are fuel and oxidant  
respectively and the first and second electrodes  
are an anode and a cathode, respectively.

2025 RELEASE UNDER E.O. 14176

8. The separator of claim 1 comprising a thermoplastic sheet.

9. The separator of claim 8 wherein the thermoplastic is a polyimide.

10. The separator of claim 8 wherein the first set of fluid distribution features is formed in the thermoplastic sheet.

11. The separator of claim 8 wherein the first set of fluid distribution features is applied to the thermoplastic sheet.

12. The separator of claim 11 wherein the first set of fluid distribution features comprises silicone.

13. A fuel cell comprising the separator of claim 1.

14. The fuel cell of claim 13 wherein the separator is bonded to the periphery of the membrane electrode assembly.

15. The fuel cell of claim 14 wherein the separator is bonded to the membrane electrolyte in the membrane electrode assembly.

16. The fuel cell of claim 14 wherein the separator is bonded to first and second thermoplastic sheets and the thermoplastic sheets penetrate into and are bonded to the first and  
5 second porous electrodes respectively at the periphery of the membrane electrode assembly.

17. The fuel cell of claim 16 wherein the separator is encapsulated by the first and second thermoplastic sheets.

18. The fuel cell of claim 14 wherein the separator is an extension of a fluid diffusion layer in one of the electrodes.

19. The fuel cell of claim 13 wherein the separator is bonded to the first flow field plate.

20. The fuel cell of claim 13 wherein the membrane electrode assembly is rectangular.

21. The fuel cell of claim 20 comprising an additional separator wherein the separator and the additional separator are sealingly engaged to opposite ends of the membrane electrode assembly.

22. The fuel cell of claim 13 wherein the fuel cell is a solid polymer electrolyte fuel cell.

2025 RELEASE UNDER E.O. 14176

23. The fuel cell of claim 13 wherein the flow field plate is corrugated.

24. The fuel cell of claim 23 wherein the flow field plate is metallic.

25. A method of separating and distributing fluids in a fuel cell, the fuel cell comprising a substantially planar membrane electrode assembly having first and second electrodes assembled onto 5 opposing major surfaces of a substantially planar membrane electrolyte, and first and second flow field plates adjacent major surfaces of the first and second electrodes respectively, the method comprising:

- 10 (a) forming a first port in a separator to allow a first fluid to pass therethrough;
- (b) providing a first set of fluid distribution features in the separator to fluidly connect the first port to the flow field in the first flow field plate and to fluidly isolate the first port from the flow field in the second flow field plate; and
- 15 (c) sealing the separator to the periphery of the membrane electrode assembly and to the first and second flow field plates.

26. The method of claim 25 further comprising:

- (d) forming a second port in the separator to allow a second fluid to pass therethrough;
- 5 (e) providing a second set of fluid distribution features in the separator to fluidly connect the second port to the flow field in the second flow field plate and to fluidly isolate the second port from the flow field in the first flow field plate.

10 27. The method of claim 25 wherein the first set of fluid distribution features comprises a plurality of channels separated by lands for directing the first fluid to a plurality of 5 channels in the first flow field plate.